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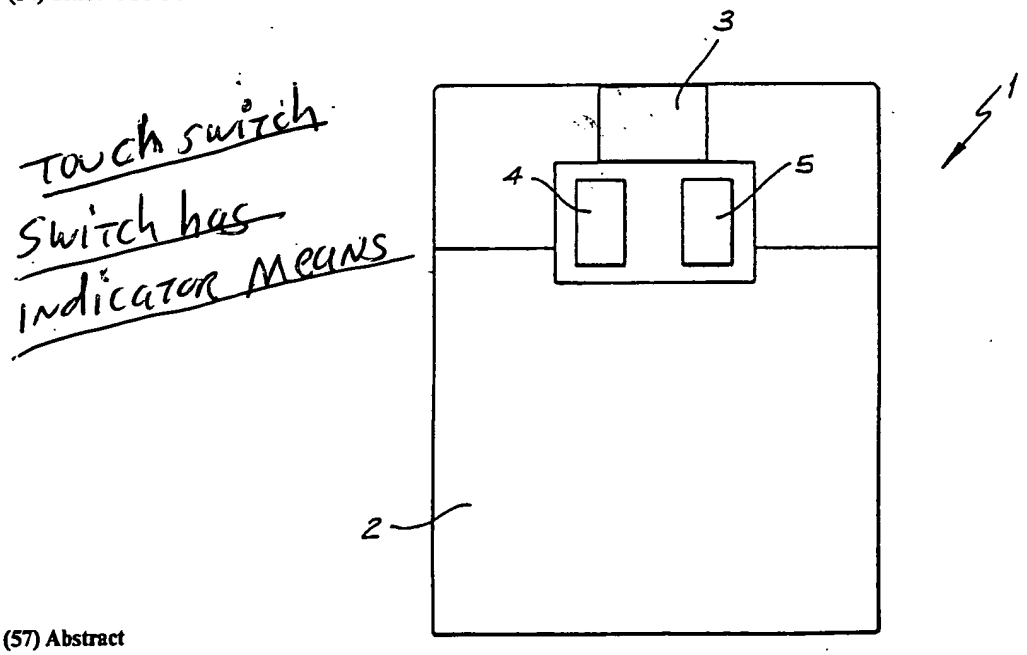

Touch switch
Switch has
indicator means

(57) Abstract

A mouse with a non pressure-dependent switch is used as an input device for a computer. The inventors have found that persistent actuation of the mechanical input switch on conventional mice can cause repetition strain injuries in the users. The present invention provides a mouse (1) with a touch sensitive area (3) requiring no pressure to operate the switch as an alternative to pressure dependent switches (4 et 5). An indicator indicates to the user when the switch has been operated. The indicator is preferably a relay which is activated at the same time that the switch is activated and causes vibrations and/or sound to be transmitted to the user. An ergonomic arrangement with a full rear touch pad (2) and a centrally located top touch pad (3) for ambidextrous use is described in detail. Alternative forms of non-pressure dependent switches are also suggested.

* See back of page

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MOUSE WITH NON-PRESSURE DEPENDENT SWITCH

The present invention relates generally to the area of computer peripheral input devices, and particularly, but not exclusively, to the peripheral input device commonly known as the mouse.

A computer mouse enables an operator to quickly input data to a computer by means of cursor driven software. A conventional mouse comprises a means for operating a cursor on a computer display device, commonly a ball and switch arrangement, and one or more switches actuatable by a user to provide on/off data input. The switches actuatable by the user are usually microswitches, which are operable by means of pushbuttons mounted on a convenient part of the mouse body.

A problem with the use of the conventional mouse, however, would seem to be the possibility of producing repetitive strain injury (RSI). This has been found to manifest itself as an intense pain in the hand, arm and shoulder of persons involved in intensive use of a computer mouse. Continuing to use a mouse in this situation even though pain is being caused can lead to serious injury. Users can become so disabled that they cannot continue to use a mouse. It has been found that changing the hands one uses the mouse with is only a temporary solution to this problem.

On investigating the mouse induced RSI problem it was found that the persistent action of depressing the mouse button in order to actuate the microswitch was a major factor. The measured minimum pressure needed to actuate such buttons was found to be between 150 to 210 grams, depending on the type of mouse used. Actual pressure tests, however, indicated that between twice and ten times this force is applied in actual operation by a user. Operation may be repeated perhaps thousands of times. This would be akin to moving a thousand gram weight with a

finger tip for thousands of times!

It was also observed that latent tension in the button finger, even when not in use, was maintained. After ten to twenty minutes of mousing the finger becomes more tense, perhaps responding to constant calls to be brought swiftly into action. This has advantages as regards operation of the computer as it increases throughput, but is physically very disadvantageous. In normal movement, both opposing groups of muscles that lift and lower the button finger will act alternatively. However, when employed to repeatedly push a button rapidly the two muscle groups (which are actually located in the forearm) are both in a constant state of tension and oppose each other. A small deflection of the button is then achieved by shifting the balance of this tension.

Both the factors discussed above, that of latent tension and increased force, we believe lead to the problem of RSI.

There is therefore a need for a computer mouse which has all the advantages of fast and convenient data input to a computer but which mitigates problems such as RSI.

The present invention provides a mouse for inputting information to a computer, the mouse comprising means arranged to direct a cursor on a computer display unit and switch means comprising user operable means for operation of the switch means to input information and/or commands to the computer, the user operable means not being dependent on pressure being exerted by the user to operate the switch means.

By providing a switch which is actuatable without the need to apply pressure by the user we have found that the problem of RSI is greatly reduced. The user need merely touch, for example, and not press in order to input data.

Preferably, the present invention may be arranged on a mouse together with a standard mechanical switch, in

order to provide maximum variation to the way in which a user may enter data. For example, the user may spend a period using the normal mechanical switch until he is tired, and then may change to using the non-pressure dependent switch in accordance with the present invention to provide variation of movement and obtain rest thereby. We have found that such variation is extremely advantageous when it comes to avoiding RSI.

The user operable means is preferably placed so as to allow for ambidextrous use. This also enables the user to swap hands at will.

Preferably, the mouse in accordance with the present invention is provided with an area or areas on its surface to which a user can move a finger to cause the switch means to be actuated. For example, this could be achieved by use of a touch-sensitive switch which utilizes the conductivity of the hand to complete a circuit causing operation of the switch means. Operation of the switch means by touching the area will require no significant pressure.

One advantage of the mechanical type depressive switch is that the user knows when he is pressing it. He may hear an audible click, for example, and he will feel that the switch has been depressed. A problem with a switch which is touch or area sensitive, such as in the present invention, is that no substantial feedback is provided to the user in order to indicate to him that the switch means has been actuated. Preferably, the switch means of the mouse of the present invention includes an indicator means for providing an indication to the user that the switch means has been operated. This means is preferably electromechanical, such as a relay, which is responsive to activation of the switch circuitry to cause a vibration and/or sound to be transmitted to the user.

Where a touch area is utilized for actuation of the

switch means, we have found that the most convenient location for it is at the front on top of the mouse located centrally. This is ergonomically the most convenient position for ambidextrous use.

In the case where the touch area is part of a touch sensitive circuit arranged to be electrically completed by a user's hand, two touch pads are provided. A first touch pad is preferably provided at the rear on top of the mouse where the user can conveniently rest the heel of their hand or palm. The other pad is preferably mounted centrally at the front top of the mouse for ambidextrous use. Provision of the rear pad as a resting surface for the palm or hand encourages the user to utilize the most restful method of using a mouse.

The switch means in the mouse of the present invention also preferably includes an hysteresis factor to make sure of clean switching and a low pass filter to avoid switching of the circuit by extraneous electrical signals which may be coupled in. An advantage of the present invention is that it provides for the reduction of the RSI problem and therefore allows continued use of a peripheral input mouse. Muscular tension in the hand and body of a user is reduced and other tension and stress factors are also reduced. The invention also results in increased ease and increased speed of operation without any user having to change dramatically the habits of mouse actuation he is used to.

The present invention further provides a switching arrangement for a mouse for inputting information to a computer, the switching arrangement comprising switch means arranged on operation to cause the mouse to input information and/or commands to the computer, said switch means comprising user operable means for operation of the switch means, the user operable means not being dependent on pressure being exerted by the user to operate the

switch means, said switching arrangement being adapted for mounting on a mouse.

It is also envisaged in the present invention that mice already in existence could be adapted in accordance with the present invention by modifying them to include said switching arrangement.

This switching arrangement may also have all the modifications and alternatives discussed above in relation to the switch means of the mouse of the present invention.

Features and advantages of the present invention will become apparent from the following description of embodiments thereof, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 shows a schematic top plan view of a mouse in accordance with the present invention, illustrating touch sensitive pads together with normal mechanical actuators;

Fig. 2 shows a side view of the mouse of Fig. 1.

Fig. 3 shows one embodiment of an electronic circuit for switch means in accordance with the present invention; and

Fig. 4 shows a further embodiment of an electronic circuit for switch means in accordance with the present invention, and

Fig. 5 shows a schematic block circuit diagram of mouse circuitry in accordance with the present invention.

Referring to Fig. 1, a top plan schematic view of a mouse in accordance with the present invention is illustrated. The mouse 1 is provided with touch sensitive pads 2, 3 which, when electrically connected by a user's skin, operate a switch means to cause input of data/information to a computer to which the mouse 1 may be attached. Touch sensitive pads 2, 3 will be made of conductive material. Pad 2 is arranged at the rear top side of the mouse and is conveniently adapted for the user to rest their palm or heel of hand on the pad 2. In this

way the mouse may conveniently be steered in order to regulate the position of a cursor on a computer display screen. All the user need then do in order to actuate the switch means to input information/data to the computer is move his finger onto the pad 3, which is arranged conveniently at the front top side, centrally, of the mouse. This design for the touch sensitive pads has been found to be extremely ergonomically efficient and to enable ambidextrous use.

The rear pad 2 is shaped to cover all the rear part of the mouse 1, extending over the sides of the mouse 1 so that the user may "roll" his hand and still be in contact with the rear pad 2.

In addition to touch sensitive pads, normal mechanical switches 4, 5 are also provided on the mouse at either side of the front touch sensitive pad 3. Provision of normal buttons 4, 5 means that the user may vary at will the way in which the switch means is operated. This will enable them to rest their hand when they are tired of one particular movement.

Note that any number of switch means may be provided within the mouse for actuation by any number of buttons, as desired.

Please note that, apart from the adaptations of the present invention, the mouse otherwise includes ball and switch means or the like for controlling the position of a cursor on the computer display unit, interface circuitry and circuitry for inputting data/information to the computer. These may be standard.

Fig. 5 illustrates a schematic block diagram of mouse circuitry in accordance with an embodiment of the present invention. Reference numeral 20 represents the mouse and 25 represents a two-way bus for connection to a computer. A ball and switch arrangement 24 provides x, y positional data to a cursor via interface circuitry 23.

A mechanical switch 21 and touch switch means 26 in accordance with the present invention operate a microswitch 22 and associated circuitry to input data/information to the computer.

Fig. 3 illustrates a switching circuitry arrangement which may be utilized in a mouse in accordance with an embodiment of the present invention. Reference numerals 2 and 3 illustrate the touch sensitive pads on the surface of the mouse 1. 2 is the ground pad, connected to ground via resistor R3 and 3 is the pad to be activated by the finger and connected to the voltage supply V.

Electrical connection of pads 2 and 3 by a user's skin causes the input voltage of Schmitt trigger inverter 01 to drop to such a level to cause the output to go high (low input/high output). Resistor R1 is chosen to be of large value to take into account the usual large value of human skin resistance and to ensure that inverter 01 switches output. The output of inverters 02 is thus caused to go low actuating a microswitch in conventional mouse circuitry via diode D1 in order to input information/data to a computer connected to the mouse. Reference numeral 10 represents the microswitch and associated mouse circuitry. Diode D 1 is used to ensure independent operation of the touch switch and any mechanical switch also connected to the microswitch. 01 is a Schmitt input inverter in order to provide hysteresis to ensure a clean decision on actuation of the switch. All other inverters are also Schmitt for convenience. The input resistance of 01 is also chosen to be high in order to be greater than the resistance expected of the human skin (up to 10 M). A CMOS device is therefore preferred for 01.

The output of 01 also drives a ganged set of three inverters 03, 04 and 05. When the switch is actuated their respective outputs will drop low, which will cause

actuation of relay RE. Relay RE is mounted rigidly either to the housing of the mouse 1 or a circuit board within the mouse so that its activation will cause a vibration to be passed to the hand of the user to indicate that the switch has indeed been actuated. The relay RE also gives out a "click" sound on activation. The ganging together of three inverters 03, 04 and 05 provides sufficient current to drive the relay RE. The relay is bipassed by diode D2 to absorb the inductive energy. Capacitor C2 is provided between voltage rail and ground.

Any user touching the input pad may possibly be energized by external interfering electrical fields, such as from mains wiring which may be in his immediate vicinity. The extraneous oscillating voltage which could be generated by this could cause false triggering of the mouse circuit. A filter circuit, comprising resistor R2 and capacitor C1 is included to reduce this problem. The values of these will be chosen in order to filter out any possible extraneous oscillating signals (e.g., 50Hz mains frequency). Resistors R2 and R3 are also chosen to provide a current limiting function.

Examples of component values are given below:-

R1 = 10 MΩ

R2 = 100 KΩ

R3 = 100 KΩ

C1 = .01μF

C2 = 1 μF

V = +5V

The inverters may be constituted by a SMD74HC14 chip.

The above circuitry is adapted for mounting in a mouse by mounting it on an appropriately sized circuit board. The top housing of the mouse may be replaced by a redesigned housing including conductive pads 2, 3.

Fig. 4 shows another embodiment of circuitry which could be used in the present invention. This further

embodiment operates in a similar manner to the embodiment of Fig. 3 but uses Schmitt trigger NAND gates N1 to N4 to control the switch means. In this case, however, two front touch pads are provided, 3, 3. Electrical connection of either one of these pads with ground pad 2 will cause actuation of the switch means circuitry. Resistors R4 and R6 are pull-up resistors and operate in a similar manner to resistor R1 of Fig. 2 and would be chosen with similar values. Resistor capacitor arrangements R5, C3 and R7, C4 act to filter out extraneous signals in a similar manner to R2, C1 combination of Fig. 2. NAND gates N1 and N2 input to NAND gate N3 which drives the output to the microswitch in a similar manner to inverter 02 of Fig. 2. Diode D3 operates in the same manner as diode D1. Gate N4 activates relay RE via transistor T, which provides the necessary running current as opposed to the three ganged together inverters 03 to 05 of Fig. 2. Transistor T is driven via input resistor R6. Diode D4 acts to absorb the inductive energy of relay RE. Capacitor C5 is provided between the voltage rail and ground and resistor R7 acts as current limiting resistor for the ground pad 2. This embodiment allows two finger pads to be placed next to each other at the front surface of the mouse as an alternative arrangement.

An arrangement requiring two touch sensitive pads to be touched at the same time so that electrical contact is made between them in order to drive the switch means need not necessarily be used in the present invention. Other touch sensitive switches or switches which require an area on the mouse just to be moved into could be used. For example, the following solutions could be utilized.

A. Touch switch using the body's electrical capacitance.

B. Touch switch using stray coupling to the body.

C. Non-touch switch using proximity detector.

D. Non-touch switch using light beam interruption.

The invention could also be put into practice with input peripheral devices which are similar in construction to the mouse but which may not exactly be mice. For example, the track ball input device, where the user rolls a ball with his palm to move a cursor on a screen, could be adapted for use with the present invention by including finger areas in front of the track ball which only need to be touched to actuate a switch to input data or information to the computer.

CLAIMS:-

1. A mouse for inputting information to a computer, the mouse comprising means arranged to direct a cursor on a computer display unit and switch means comprising user operable means for operation of the switch means to input information and/or commands to the computer, the user operable means not being dependent on pressure being exerted by the user to operate the switch means.

2. A mouse in accordance with claim 1, wherein said user operable means comprises an area accessible to the user on the surface of the mouse to which the user can move a part of his hand in order to operate the switch.

3. A mouse in accordance with claims 1 or 2, wherein said switch means further comprises indicator means for providing an indication to the user that the switch means has been operated.

4. A mouse in accordance with claim 3, wherein said indicator means comprises electromechanical means arranged to be actuated by operation of the switch means.

5. A mouse in accordance with claim 4, wherein said electromechanical means is arranged to transmit vibration and/or sound to the user on operation of the switch means.

6. A mouse in accordance with any preceding claim, wherein the switch means further comprises filter means arranged to prevent operation of the switch means by extraneous electrical signals.

7. A mouse in accordance with any of claims 2 to 6, wherein the user accessible area is located centrally on top and to the front of the mouse in order to enable ambidextrous operation.

8. A mouse in accordance with any of claims 2 to 7, wherein two touch pads are provided and are arranged to be electrically connected by a user's hand to complete a circuit and operate the switch means.

9. A mouse in accordance with claim 8, wherein one of the two touch pads is located on the surface of the mouse at the rear where a user may rest the heel or palm of their hand, and the other touch pad is located at the front of the mouse for ease of access by a finger of the user.

10. A mouse in accordance with any preceding claim, wherein a mechanical actuator is also provided for operation by the user in order to operate the switch means, operation of the mechanical actuator being by applied pressure from the user.

11. A switching arrangement for a mouse for inputting information to a computer, the switching arrangement comprising switch means arranged on operation to cause the mouse to input information and/or commands to the computer, said switch means comprising user operable means for operation fo the switch means, the user operable means not being dependent on pressure being exerted by the user to operate the switch means, said switching arrangement being adapted for mounting on a mouse.

12. A switching arrangement in accordance with claim 11, wherein said user operable means comprises an area accessible to the user and adapted for mounting of the surface of the mouse to which the user can move a part of his hand in order to operate the switch.

13. A switching arrangement in accordance with claim 12, wherein said switch means further comprises indicator means for providing an indication to the user that the switch means has been operated.

14. A switching arrangement in accordance with claim 13, wherein said indicator means comprises electromechanical means arranged to be actuated by operation of the switch means.

15. A switching arrangement in accordance with claim 14, wherein said electromechanical means is arranged to transmit vibration and/or sound to the user on operation of the switch means.

16. A switching arrangement in accordance with nay of claims 11 to 15, wherein the switch means further comprises filter means arranged to prevent operation of the switch means by extraneous electrical signals.

17. A switching arrangement in accordance with any of claims 12 to 16, wherein two touch pads are provided and are arranged to be electrically connected by a user's hand to complete a circuit and operate the switch means.

1/4

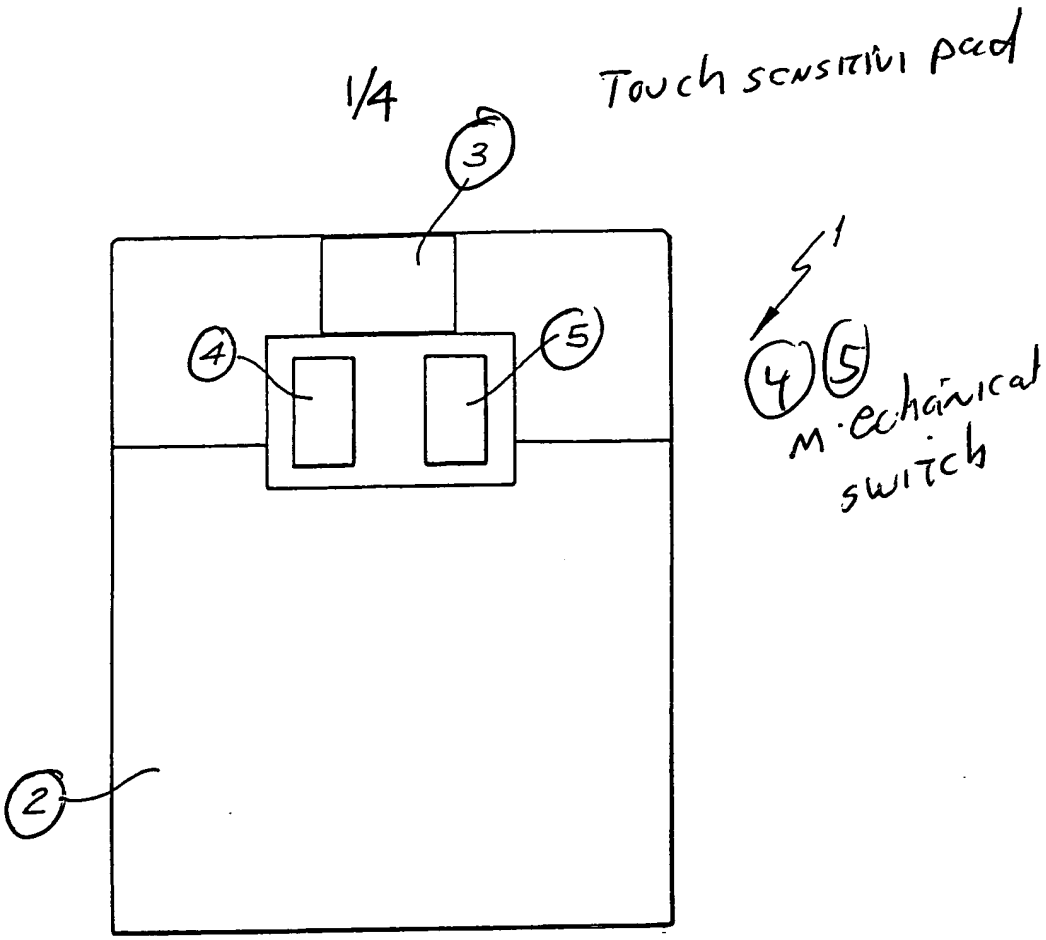
Touch sensitive pad
3
1
4
5
4
5
mechanical switch
2
Touch sensitive

FIG. 1

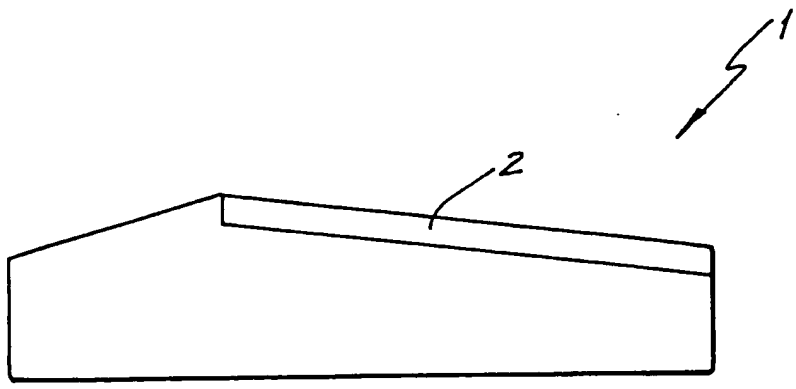
1
2

FIG. 2

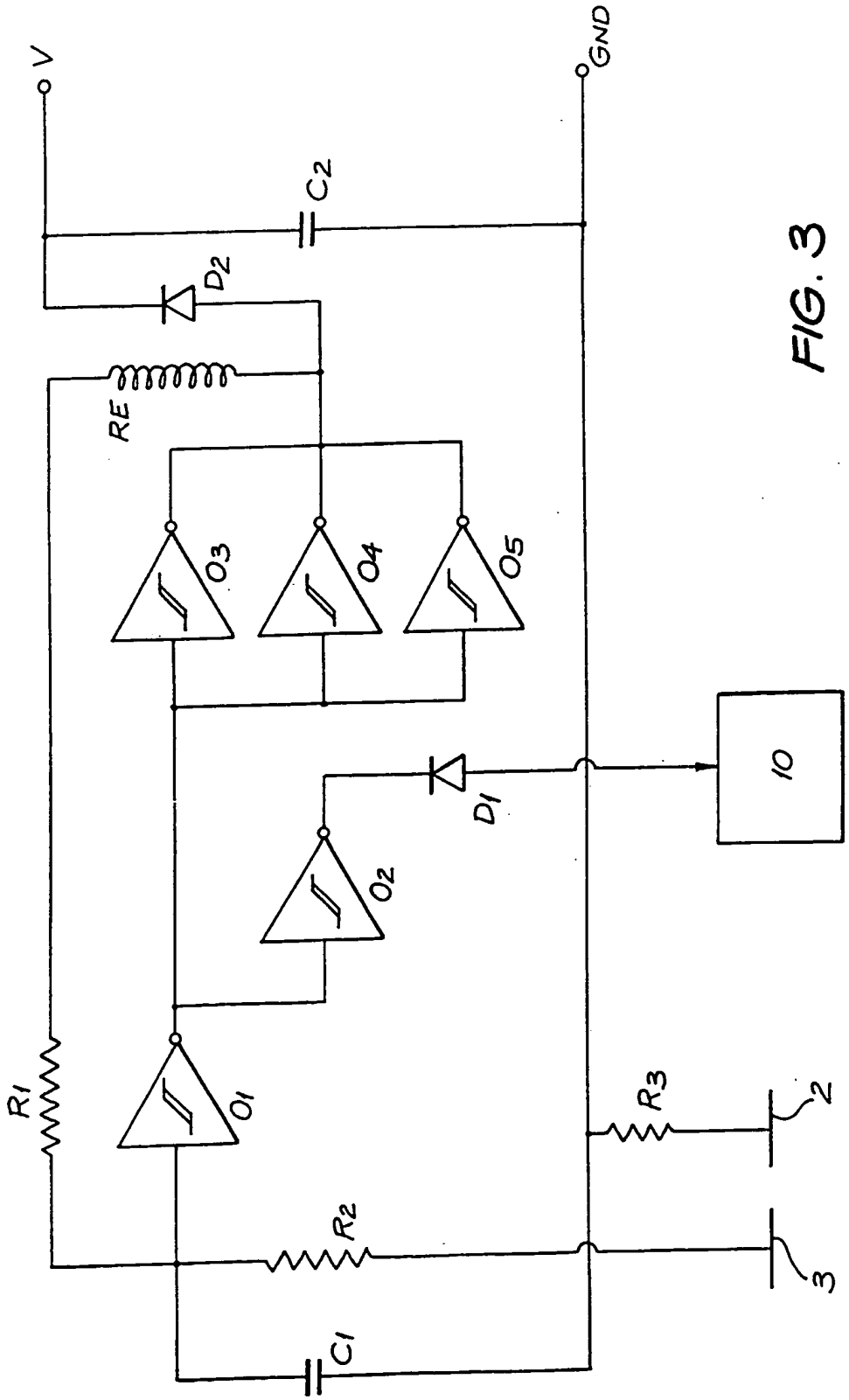

FIG. 3

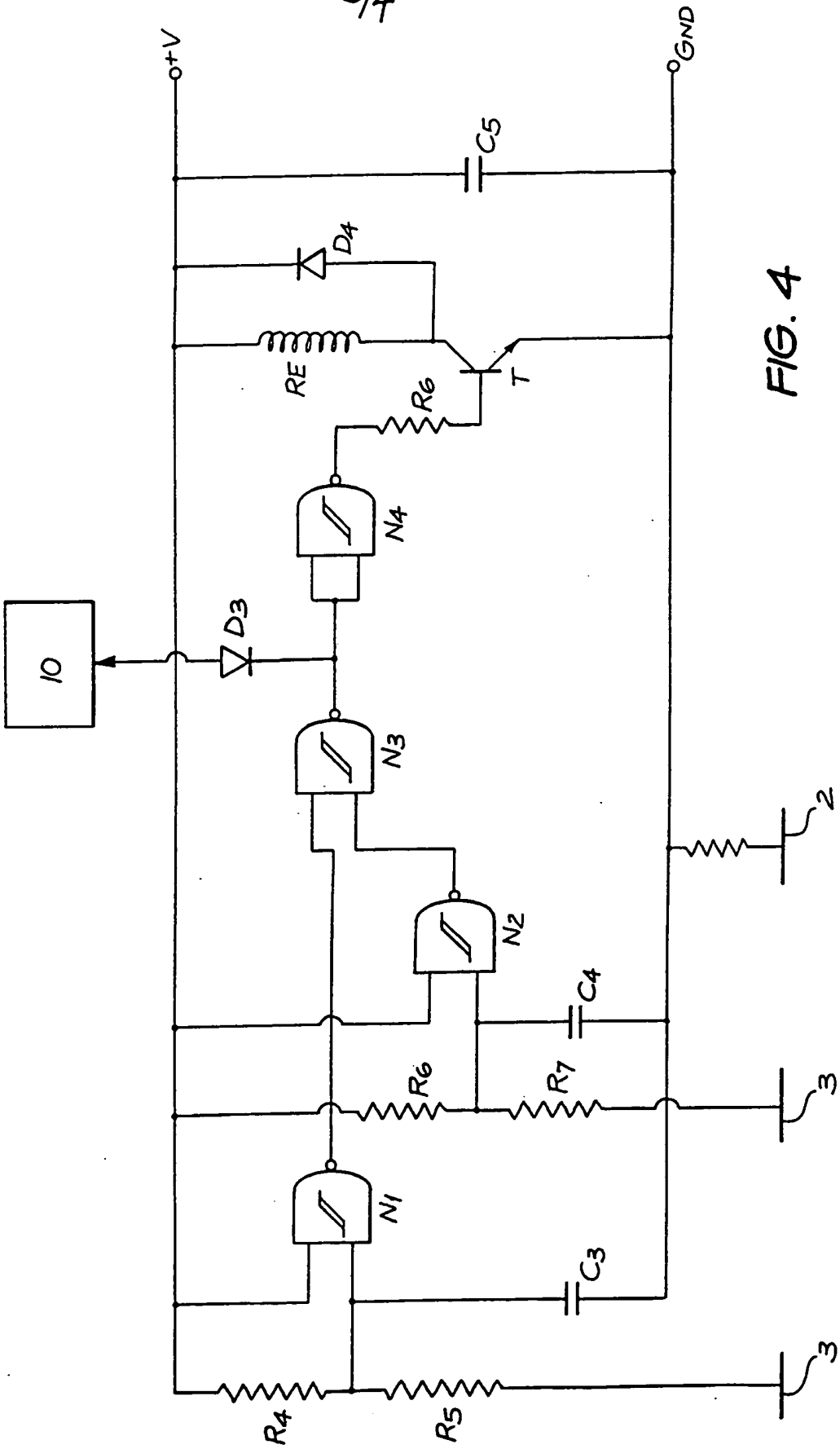

FIG. 4

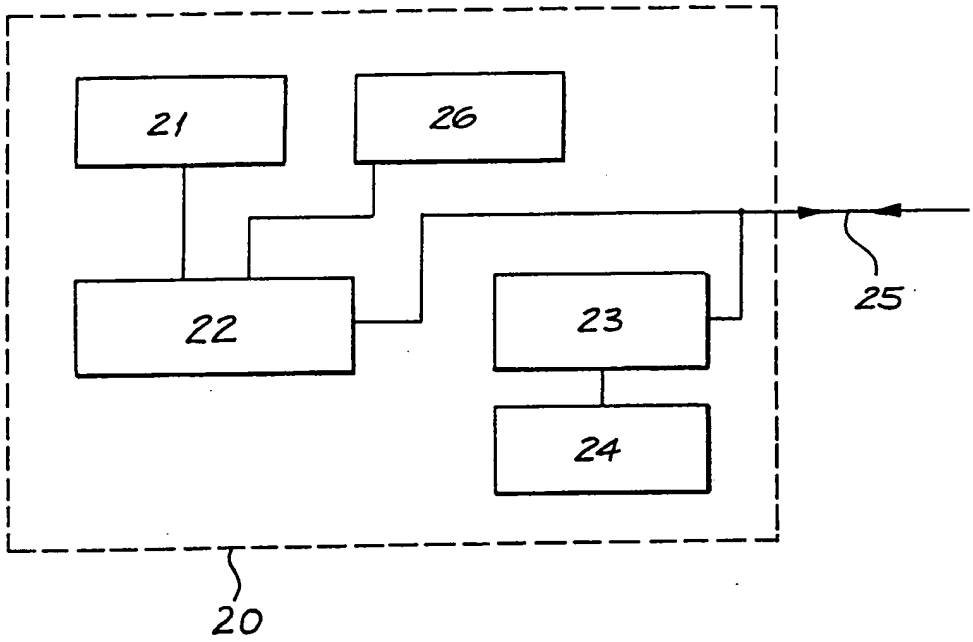

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 90/00194

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[5] G06F 3/02, 3/033

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC	G06F and keyword, "MOUSE"

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
P,X	Patents Abstracts of Japan, P-984, page 156, JP,A, 1-253023 (SUMITOMO ELECTRIC IND LTD) 9 October 1989 (09.10.89)	(1,2,7,8,10,11, 12,17)
X	Patents Abstracts of Japan, P-953, page 50, JP,A, 1-191926 (TECHNO MEDEIA KONPURETSUKUSU K.K.) 2 August 1989 (02.08.89)	(1,2,11,12)
X	Patents Abstracts of Japan, P-886, page 59, JP,A, 1-57327 (NEC CORP) 3 March 1989 (03.03.89)	(1,2,11,12)
X	Patents Abstracts of Japan, P-801, page 17, JP,A, 63-195722 (CANON INC) 12 August 1988 (12.08.88)	(1,2,11,12)
X	Patents Abstracts of Japan, P-729, page 110, JP,A, 63-37419 (HISASHI NAGATSUMA) 18 February 1988 (18.02.88)	(1,2,11,12)

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
18 July 1990 (18.07.90)	24 July 1990
International Searching Authority	Signature of Authorized Officer
Australian Patent Office	John Thomson J.W. THOMSON